

APPENDIX 1. Research Ideas to Support Future Revisions of Standard 62.1 (Submitted by SSPC62.1 to TAC, RAC and EHC: November 2, 2001)

Over the years, there have been many discussions at SSPC meetings that have identified the need for research. This list of research ideas has been generated by SSPC 62.1 to capture some of the issues that merit research in order to support future revisions of ASHRAE Standard 62. These ideas will be submitted to the appropriate TC or TCs, along with the name of an SSPC member who can work with the TC as needed to provide the background, review work statements and perhaps serve on a project monitoring committee.

Development of method to express perceived IAQ

While it is generally acknowledged that perception of odor and irritation are important components of IAQ, the ability to quantify such aspects of perception are not very well established. While the olf-decipol concept has proven useful, questions and concerns remain. The objective of this research would be to develop and evaluate one or more concepts for quantifying perceived IAQ, including how to achieve different levels of occupant acceptance, field studies to verify chamber studies and development of chemical and other analytic measures to replace questionnaires and panels.

TC: 2.1, 4.3

SSPC contact: Jan Sundell

Perceived air quality from combinations of sources

Given that a number of different sources (e.g. people, materials and activities) contribute to perceived IAQ, the question exists of how best to determine their combined impacts. The objective of this research would be to develop and evaluate one or more concepts for determining the combined impacts of different sources on perceived IAQ and to determine the ventilation rate required to address these combinations of sources.

TC: 2.1, 4.3

SSPC contact: Jim Tshudy

Impacts of occupant adaption on perceived indoor air quality

Research has shown that people adapt to certain sources impacting perceived IAQ, such as human bioeffluents, but do not seem to adapt as quickly, if at all, to others. Research is needed to study the extent of adaptation to different classes of sources and time required for such adaptation to occur. This work would involve controlled chamber studies as well as field studies to verify the chamber study results..

TC: 2.1, 4.3

SSPC contact: Jan Sundell

Ventilation requirements to address perceived air quality from ETS

Many individuals, perhaps even the majority in some populations, find detectable odor of ETS unacceptable and will be dissatisfied in any environment where the odor of ETS is perceptible. Efforts to develop ventilation requirements to control odor and irritation from environmental tobacco smoke depend on knowledge of the odor threshold for ETS in the current population. However, the research on ventilation requirements to control odor and irritation from environmental tobacco smoke is relatively old. The objective of this research would be to determine the ventilation required to control odor and irritation from ETS as a function of smoking activity, time of exposure of subjects (adaptation impacts) and other factors.

TC: 2.1, 4.3

SSPC contact: Larry Schoen

ETS removal effectiveness

In designing spaces where smoking is permitted, it is generally desirable to remove ETS before it has had a chance to mix throughout the space. The same objective is relevant when designing spaces that contain both smoking-permitted and smoking-prohibited areas. A number of different approaches have been

advocated to maximize ETS removal effectiveness and to prevent ETS migration from smoking areas to nonsmoking areas, including displacement ventilation. The objective of this research would be to investigate different ventilation strategies as to their effectiveness in terms of ETS removal and control.

TC: 2.1, 4.3

SSPC contact: Larry Schoen

Determination of drain pan length

The current proposal being discussed in SSPC 62.1 is a prescriptive drain pan length of $1/2$ the coil height, with the implication being it will result in no more than the performance-based carryover limit of $1/5$ ml per m^2 . Questions exist as to the impact of coil slant and other configuration issues along with off-design operating conditions. The objective of this research would be to determine how beset to relate coil height and configuration to drain pan length.

TC: uncertain

SSPC contact: John McFarland

Design based on contaminant loads

More attention should be focused on the goal of designing for IAQ analogously to how we design for cooling loads or structural loads. To support a loads based approach to IAQ design, the following research needs exist: emission data and emission models; sink data and sink models; health- and comfort-based exposure limits; and, air cleaning technologies and test methods for rating the performance of these technologies. The objective of this research could be to determine what is needed to enable such design approaches, to acquire that data or to develop the design methods.

TC: 2.1, 2.3, 2.4, 4.3?

SSPC contact: Andy Persily

IAQ benefits of documentation, commissioning and O&M

Most people agree that in addition to good design, achieving acceptable indoor air quality also requires effective design documentation, commissioning and operation & maintenance. Research on building performance also needs to address the whole lifetime of the building and the ventilation system, including maintainability. The objective of this research could be to establish the costs and benefits of these beyond-design efforts

TC: 1.7, 9.9

SSPC contacts: Mike Mamayek, Eli Howard

Natural and hybrid ventilation system design and performance

Natural and hybrid ventilation systems are being advocated as a means of saving energy and providing quality indoor environments. However questions exists as to the reliability of the ventilation rates achieved, air distribution, outdoor air quality and other issues. The objective of this research would be to perform field studies of passive and hybrid ventilation buildings, modelling studies of passive ventilation systems, and development of design tools that allow the integration of data on weather, building configuration and openings, and airflow patterns.

TC: 4.3, 9.1?

SSPC contact: Andy Persily

Ventilation to control building emissions

Contaminant emissions from building materials, furnishings and processes have been identified as of important to IAQ. However many questions remain as to their impact and control. This research project, or projects, would focus on the following:

- Literature review relating to characterization and measurement of emissions from buildings and related products, the concentrations of constituents in unoccupied spaces, the effect of ventilation on concentrations or occupant perceptions

- Development of a protocol for characterization and measurement of concentrations of constituents in unoccupied spaces and the effect of ventilation in various occupancy categories

Where data are insufficient in the literature (as evaluated against the protocol), studies to implement the protocol in a cross-section of buildings in each occupancy type to provide characterization and measurement of constituents in unoccupied spaces and the effect of ventilation.

Model the relationship of non-occupant related loads and ventilation rates in various occupancy categories to allow optimization of ventilation rates

TC: 2.3, 4.3

SSPC contact: Leon Alevantis

Outdoor air treatment

Research is needed to determine the fate of constituents in outdoor air introduced as ventilation air into buildings under various filtration, air cleaning, conditioning, and distribution scenarios. This research project, or projects, would focus on the following:

- Literature review relating to characterization and measurement of constituents in outdoor air used for ventilation for buildings

- Development of a protocol for characterization and measurement of concentrations of constituents from outdoor air as they enter and pass through the ventilation system, as well as the resulting indoor air quality

- Where data are insufficient in the literature (as evaluated against the protocol), conduct studies to implement the protocol in a cross-section of buildings in each occupancy type to provide characterization and measurement of constituents representing the variations resulting from common ventilation system configurations.

- Model the relationship of outdoor air quality and ventilation rates in various occupancy categories to allow optimization of ventilation rates

TC: 2.3, 2.4

SSPC contact: Chris Muller

Reintroduction of Contaminants Through Outdoor Air Intakes

Research is needed to determine the efficacy of various configurations of exhaust and outdoor air intakes to prevent the uptake of exhausted constituents into ventilation air. This research project, or projects, would focus on the following:

- Literature review relating to characterization and measurement of constituents that migrate from building exhaust into outdoor air used for ventilation for buildings

- Development of a protocol for characterization and measurement of concentrations of constituents that migrate from building exhaust into outdoor air used for ventilation, enter and pass through the ventilation system, and in the resulting indoor air

- Where data are insufficient in the literature (as evaluated against the protocol), conduct studies to implement the protocol in a cross-section of buildings in each occupancy type to provide characterization and measurement of constituents representing the variations resulting from common ventilation system configurations.

- Model the relationship of exhaust and outdoor air intake configurations and ventilation rates in various occupancy categories to allow optimization of ventilation rates

TC: 4.3

SSPC contact: Mike Woodford

Need for Minimum and Maximum Humidity Requirements

Research is needed to determine the value to prevention of mold growth and transmission of disease as they relate to humidity levels in occupied spaces and moisture content in building components. This research project, or projects, would focus on the following:

- Literature review relating to the correlation of humidity levels in occupied space to the humidity/moisture content in building components, finishing and furnishings

- Literature review relating to the correlation of mold growth, other biological activity (e.g. dust mites, virus), or disease transmission to maximum and minimum humidity levels in occupied space or the humidity/moisture content in building components, finishing and furnishings

Develop a "moisture protocol" for characterization and measurement of concentrations of humidity and moisture correlating ambient measurements in occupied space to measurements on surfaces of materials in those spaces

Where data are insufficient in the literature (as evaluated against the moisture protocol), conduct studies to implement the protocol in a cross-section of buildings in each occupancy type to provide characterization and measurement of humidity and moisture levels.

Develop a "bio-activity protocol" for characterization and measurement of concentrations of biological agents of disease correlating them to ambient measurements in occupied space and measurements on surfaces of materials in those spaces (using the moisture protocol developed above)

Where data are insufficient in the literature (as evaluated against the bio-activity protocol), conduct studies to implement the protocol in a cross-section of buildings in each occupancy type to provide characterization and measurement of biological agents of disease

Model the relationship of biological activity and moisture to allow optimization of minimum and maximum humidity requirements

TC: 2.1, 9.1, others?

SSPC contact: Wayne Thomann

Temperature and Humidity Impacts on Acceptable Indoor Air Quality

There is a substantial body of research - including past ASHRAE research - on the effects of temperature and humidity on perceived IAQ and on the acceptability of IAQ. This research suggests that at higher temperatures and enthalpy, the air is perceived as less fresh and healthy. There is also evidence that undesirable physiological responses to air pollutants occur at higher temperatures within the ASHRAE thermal comfort envelope. This research project would involve a review of this research, identification of future research directions including, and possibly the recommendation of modifications of the scope of Std 62.1 and Std 62.2 and their relationship to Std 55. In addition, the project may also focus on the impact of natural (passive) ventilation systems on perceptions and acceptability of indoor air quality.

TC: 2.1, section 9 TC?

SSPC contact: Jan Sundell

The relationship between acceptability and satisfaction

The Final Report of ASHRAE Research Project 884 (DeDear and Brager) suggests that there is not a strong correlation between acceptability and satisfaction. Much ASHRAE historical research uses acceptability scales and then converts them to satisfaction or dissatisfaction descriptors. There is a need to further investigate the relationship between occupants' satisfaction and acceptability ratings of various indoor environmental parameters. This research should include a review of the methodologies generally used in thermal comfort and in perceived IAQ questionnaires and other research tools, both within ASHRAE and beyond.

TC: 2.1

SSPC contact: Jan Sundell

Effectiveness of evaporative coolers in the removal of ozone

Air cleaning requirements for ozone could pose a significant challenge evaporatively cooled spaces in the southwest. An evaporative cooler provides 15 to 30 air changes of outdoor air to the spaces served, typically warehouses, vehicle repair shops, make up air units, etc. Evaporative coolers take dry air and saturate it with moisture with an effectiveness (efficiency) of 75-90%, depending on the media utilized. If we can be reasonably assured that the evaporative cooler pads remove ozone, we may be able to exempt these systems from the proposed ozone requirements.

TC: 2.3, 5.7

SSPC contact: Don Koch